



Transportation Research Division



Technical Report 05-07

*Utilizing a Hot Applied Snowmobile Crossing
Mat to Eliminate HMA Abrasion*

Construction and First Interim Report, August, 2007

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Utilizing a Hot Applied Snowmobile Crossing Mat to Eliminate HMA Abrasion

Introduction

Maine has 13,200 miles of picturesque snowmobile trails that cover the entire state from Aroostook County in the north to York County in the south. Tourists have been traveling to the state to enjoy the well groomed trails and warm greetings for many years. During the winter season, the number of snowmobile registrations range between 122,000 and 77,000 dependent on the amount of snowfall and length of season. The Interconnected Trail System (ITS) and connecting trails represent roughly 3,000 miles of the states trail system. An additional 10,000+ miles of trails crisscross the ITS connecting the more than 285 snowmobile clubs around the state. The ITS was created by utilizing discontinued rail road beds and timber logging roads and a number of trails follow existing power lines. In addition, many trails are cut through the woods by the more than 30,000 Maine Snowmobile Association members and individual club members who also maintain the entire trail system to ensure that all who use the trails have a safe and enjoyable ride.

Problem Statement

Many snowmobile trails intersect with Maine State Highways. The number of snowmobiles that cross a State Highway is dependent on the type of trail. ITS trails have the majority of snowmobile traffic followed by connecting trails. When a snowmobile crosses the highway the carbide blades on the skis abrade a portion of the pavement. The amount of abrasion is proportional to the number of snowmobiles crossing the highway. A typical Hot Mix Asphalt wearing surface layer is between 1.25 and 1.5 inches in depth and snowmobiles at high traffic intersections can scour thru the wearing surface in as little as three years. In an effort to reduce or eliminate pavement wear the Department of Transportation resurfaced three high volume snowmobile crossings with Cleanosol E4190-35 Thermoplastic Snowmobile Crossing Material.

Location

Three snowmobile crossings in Aroostook County were selected to apply the snowmobile crossing material. Figure 1 contains a map of two experimental snowmobile crossing locations, one in the city of Bridgewater at the intersection of US Route 1 and ITS 83 and another in the city of Mars Hill at the intersection of US Route 1 and ITS 83A. The third crossing and a Control Section is displayed in Figure 2 and are located in the city of Presque Isle. The experimental crossing is at the intersection of State Route 167 and Connector 47. The Control Section is located at the intersection of State Street and Connector 47. All three experimental crossings and the Control Section have a high volume of snowmobile traffic.

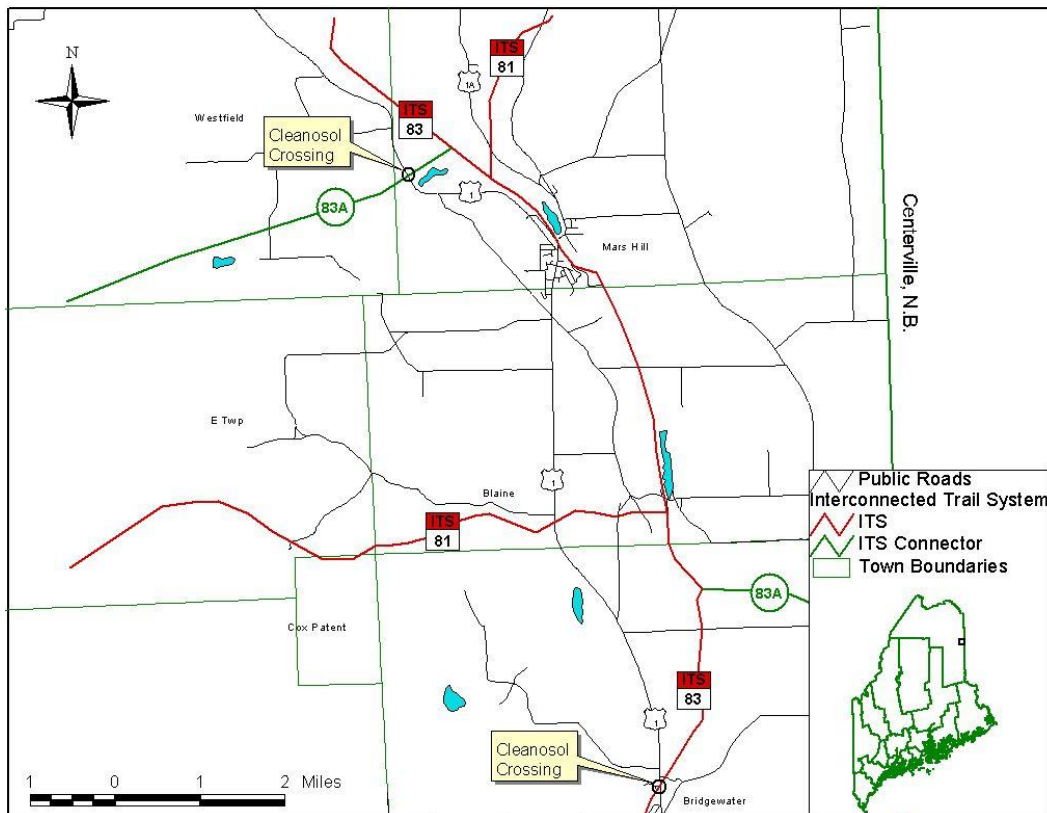


Figure 1 Bridgewater and Mars Hill Snowmobile Crossings

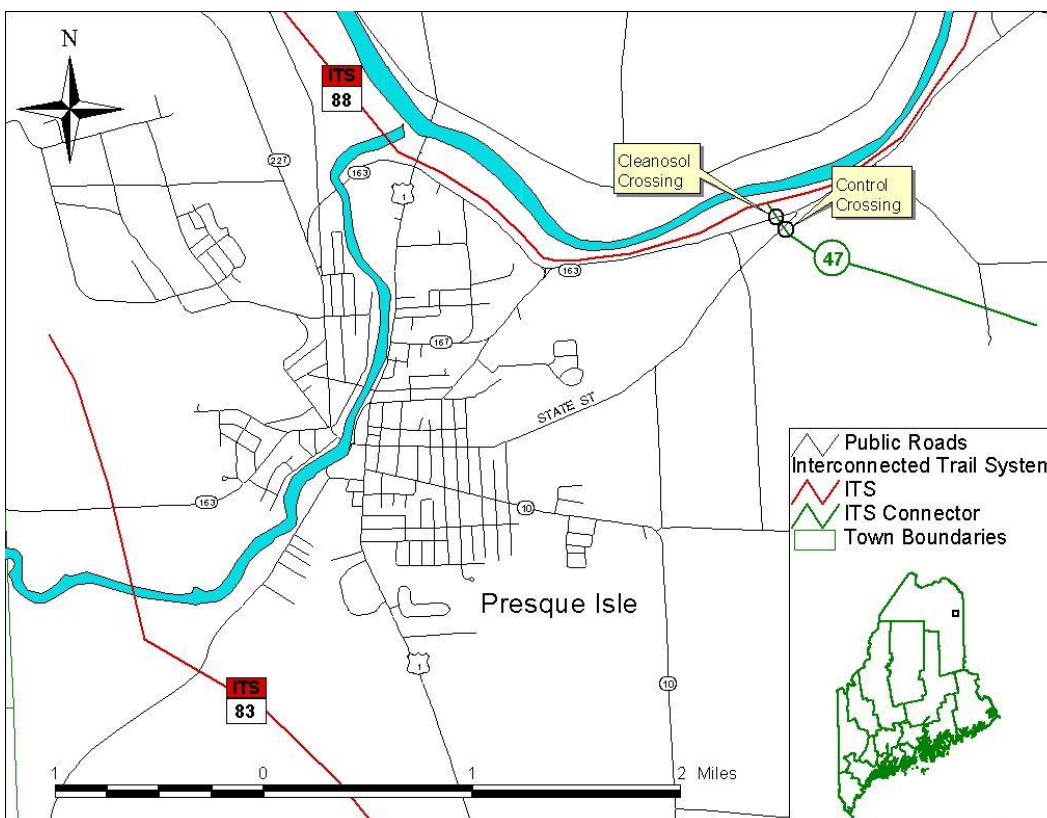


Figure 2 Presque Isle Snowmobile Crossings

Materials

Cleanosol E4190-35 Thermoplastic Snowmobile Crossing Material was utilized to protect the pavement from abrasion. Clark Highway Services from Lake City, Michigan were contracted to place the material. Material Safety Data Sheets state that at normal use E4190-35 is not classified as health hazardous is not combustible and is not considered harmful to the environment. The material is applied in three layers at a minimum depth of 0.09 inches per layer and at a temperature between 380° F and 420° F. Silica sand is spread on the surface of the hot mat to improve traction and bonding between layers. The material is colored gray to blend in with the surrounding pavement.

Construction

Cleanosol E4190-35 was placed on the snowmobile crossings on October 5, 2005. Ambient temperature at the time of construction was 50° F and rising. The surface to be treated needs to be clean, dry and above 40° F prior to sealing.

The first snowmobile crossing resurfaced was in Presque Isle on State Route 167. This is a two lane road with 4 foot paved shoulders. The shoulder was extended an additional 4 feet on either side of the snowmobile crossing for a total width of 38 feet. Traffic was maintained in one lane during construction. The area was swept and dust was blown off the surface as displayed in Photo 1.

Cleanosol E4190-35 is a solid material that needs to be heated prior to application. Application temperature is dependent on pavement temperature; higher temps are for cold pavements. A boiler is positioned on the back of the transport truck and is used to heat and distribute the material to the application cart. A chute is used to fill the application cart which has a capacity of 2 cubic feet as seen in Photo 2. The material is placed in a three layer process. The application cart places the material in 12 inch strips to a depth of 0.12 inch. Each pass is overlapped by 1 inch. Silica sand is distributed on the surface of each pass by way of a bucket attached to the back of the application cart as displayed in Photo 3. The sand adds texture to the mat and aids in the bonding between layers.

The procedure begins with starting the first layer three feet left of centerline and proceeding right to the right edge of pavement. It took 14 passes to cover the full width of the snowmobile crossing. Curing time for each pass is 2 – 3 minutes. The second layer begins \pm 3 inches inside the first layer at the butt joint and at an offset of 6 inches from the leading edge of the first layer to smooth the transition from pavement to Cleanosol, see Photo 4. The third layer begins \pm 3 inches from the underlying layer at the butt joint and is also offset 6 inches from the leading edge of the second layer. Photo 5 displays the centerline butt joint. Traffic was allowed on the mat after 15 minutes.

Photo 5 shows an overlap of all three layers for the first pass of the first layer for the second half of the crossing. This is the only pass that was placed in this fashion; the remaining strips had an overlap of 1 inch on the corresponding layer as shown in Photo 6. It appears that every pass has an overlap of 1 inch at the butt and longitudinal edge except for the beginning of each layer which has an offset of \pm 3 inches from the butt joint and 6 inches from the leading edge.

The snowmobile crossings in Mars Hill and Bridgewater were sealed with Cleanosol using the same method.

Estimated area and cost for all three crossings was 2000 square feet and \$12,000.00. The final measured area was 2169 square feet and a total cost of \$13,014.00.



Photo 1. Cleaning Right Half of Crossing.



Photo 2. Filling the Application Cart.



Photo 3. Silica Sand Distribution.



Photo 4. Starter Pass for Second Lift (6 inch offset).



Photo 5. First Pass on Left Side of Crossing



Photo 6. Proper Placement of First Layer, Left Side

Evaluation

The experimental snowmobile crossings and control crossing were inspected on August 9, 2006.

Presque Isle, State Route 167 Crossing

The State Route 167 crossing in Presque Isle is in very good condition with no apparent wear to the pavement. The mat is pliable and it appears that roadway traffic has smoothed the surface in the wheel paths.

Carbide studs on snowmobile tracks have pitted the mat as displayed in Photo 7. The pits are 0.125 inch wide and range in depth from 0.125 to 0.187 inch. Pitting is more prevalent on the roadway shoulders and at each quarter point and centerline. It appears that traffic has kneaded the mat and closed most of the holes in each wheel path.

Photo 8 displays a mark across the mat that was made from a track mounted heavy piece of equipment. This area is mainly farmland and many farmers use the snowmobile trails to transport farm equipment to the fields. The track mark penetrated the mat to a depth of 0.125 inch.

The leading edge of the mat in both directions has been worn from winter plowing mainly at centerline and the quarter points. Photo 9 displays the west bound leading edge and Photo 10 the east bound leading edge. Between 1 and 4 inches of mat is worn away. The trailing edge is intact. Traffic has worn the wheel path leading and trailing edge very smooth and even with the pavement.

Presque Isle, State Street Control Crossing

It's unfortunate that the Control Crossing didn't have new pavement prior to resurfacing the experimental crossings with Cleanosol. It would have been better to monitor the amount of pavement wear on fresh pavement rather than pavement that has already been worn from snowmobiles. In an effort to monitor the amount of snowmobile wear, snowmobile rut depths and the amount of patch material will be measured each year and the difference will be reported.

The crossing at State Street has multiple patches in the shoulders on both sides of the road as shown in Photo 11. The majority of shoulder pavement damage is caused from snowmobiles crossing the roadway from a standstill after waiting for traffic to clear. The carbide spikes tear the leading edge of the pavement until it is raveled into the travel way. At that point maintenance crews patch the shoulder to reduce the advancement of pavement ravel.

Snowmobiles have worn a rut across the roadway that is 0.25 inches deep. There are four cuts in the pavement at centerline and each quarter point that are 0.187 inches deep and range in length from 1 to 3 feet. It's difficult to determine if snowmobile carbide blades or farm machinery caused the cutting. Photo 12 displays the snowmobile rutting and cuts.

Mars Hill, US Route 1 Crossing

Snowmobile track wear and pitting in the shoulder areas are much more noticeable at this crossing than the Presque Isle crossing as revealed in Photo 13. The crossing has more snowmobile and vehicular traffic than the Presque Isle crossing. Snowmobile users may have fewer opportunities to cross the roadway and may be crossing at greater velocities from a stand still which may be increasing the amount of shoulder track wear.

Pitting was similar in width and depth as the Presque Isle crossing with the exception that the majority of pitting is in the roadway portion of the mat with very little in the shoulder areas. This could be due to mat temperature. Winter traffic may be increasing the mat temperature in the roadway portion allowing

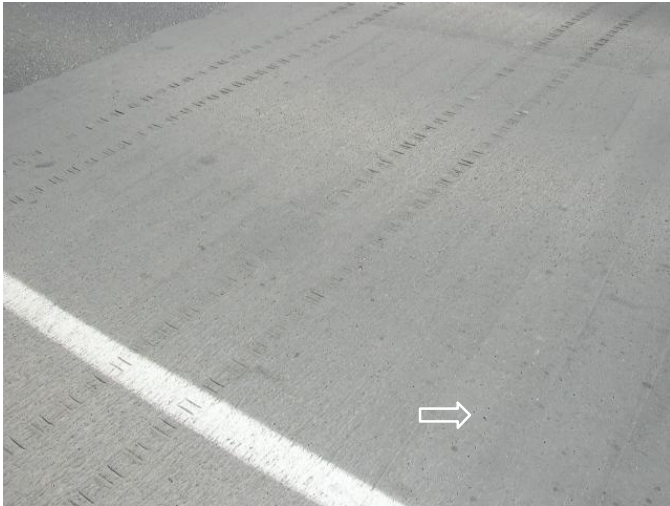


Photo 7 Presque Isle Crossing Carbide Stud Pitting



Photo 8 Presque Isle Crossing Equipment Marks

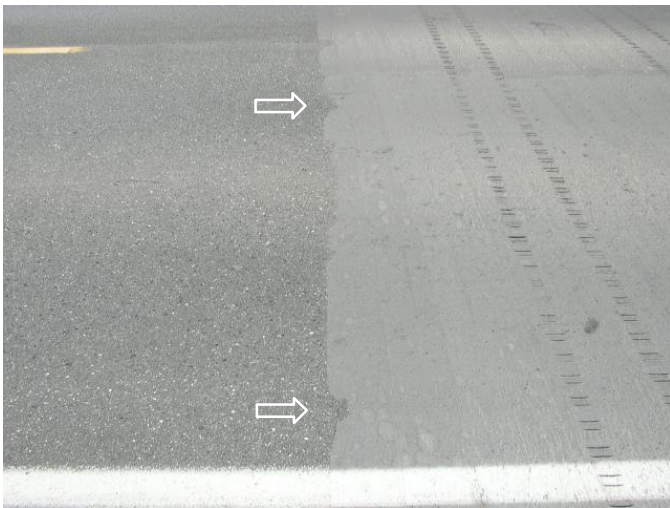


Photo 9 West Bound Leading Edge Plow Wear

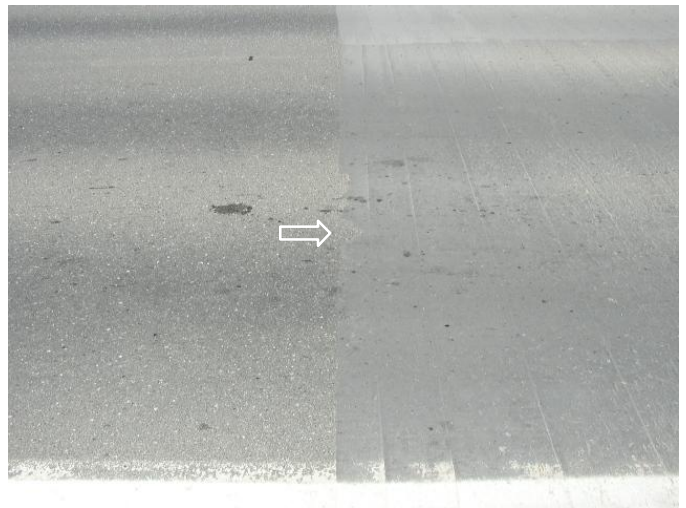


Photo 10 East Bound Leading Edge Plow Wear



Photo 11 Control Crossing Pavement Edge Patch

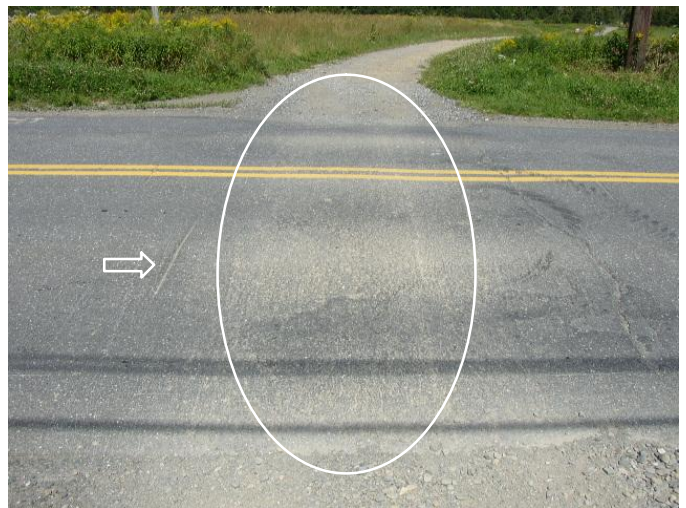


Photo 12 Control Crossing Rutting and Cuts

carbide spikes to penetrate the mat while the shoulders may be cold enough to reduce penetration. Spike and track marks in each wheel path are less noticeable; it appears that traffic kneads the mat during summer weather making the snowmobile marks less visible as shown in Photo 14 (arrow is in the wheel path).

The leading edge of the mat has plow wear at the shoulder joint, quarter point, and centerline as displayed in Photo 15. Plow wear is as much as 6 inches into the mat.

Bridgewater, US Route 1 Crossing

This crossing is skewed at a 45 degree angle and has the greatest volume of snowmobile and vehicular traffic than the other experimental and control crossings. This crossing also has an additional strip of material at the each end of the mat to square up the mat with the pavement edge as seen in Photo 16. The amount of snowmobile track wear and pitting is slightly greater than the Mars Hill crossing. Many spike holes can be seen on each end of the mat as shown in Photo 17. The roadway portion of the mat shows less pitting than each end possibly due to traffic smoothing out the marks.

US Route 1 had a cracked centerline joint prior to placing Cleanosol and the crack has reflected through the mat as seen in Photo 18. The crack has not visibly affected the mat.

This crossing has a paved sidewalk on the west side of the crossing. The sidewalk has recently been resurfaced and will be a good indicator of pavement wear.

A local farmer used the snowmobile crossing to transport a heavy piece of farm equipment. The farm equipment left ¼ inch deep marks on the paved shoulder but no visible marks on the Cleanosol mat as displayed in Photo 19. It's possible that the operator had to wait for traffic to clear prior to crossing and while waiting the track may have sunk into the hot pavement. When the equipment did cross, the track may not have had enough time to apply enough pressure on the mat to leave a mark. The same could be said about the decreased number of snowmobile spike marks in the roadway portion of the mat.

Winter plow abrasion is less severe than the Mars Hill crossing. The leading edge is worn ± 2 inches into the mat at centerline, quarter point, and shoulder joint.



Photo 13 Mars Hill Crossing Shoulder Track Wear

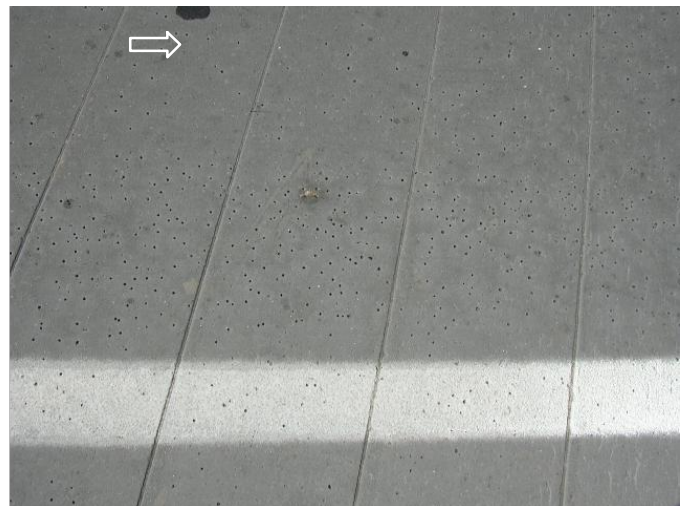


Photo 14 Mars Hill Crossing Spike Marks

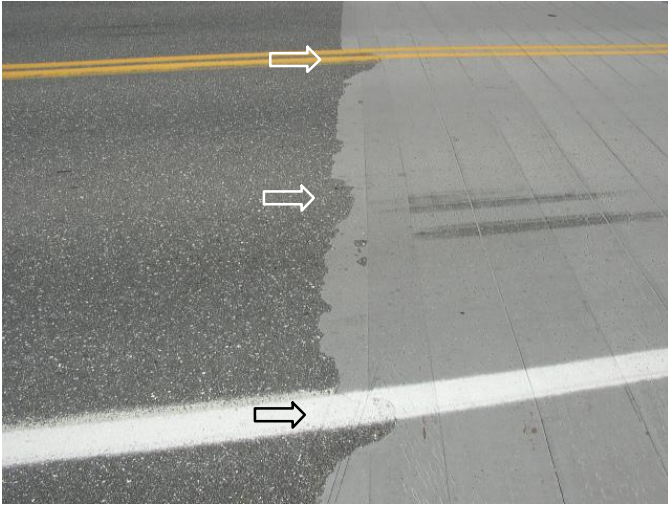


Photo 15 Mars Hill Crossing Plow Wear



Photo 16 Bridgewater Crossing Additional Strip

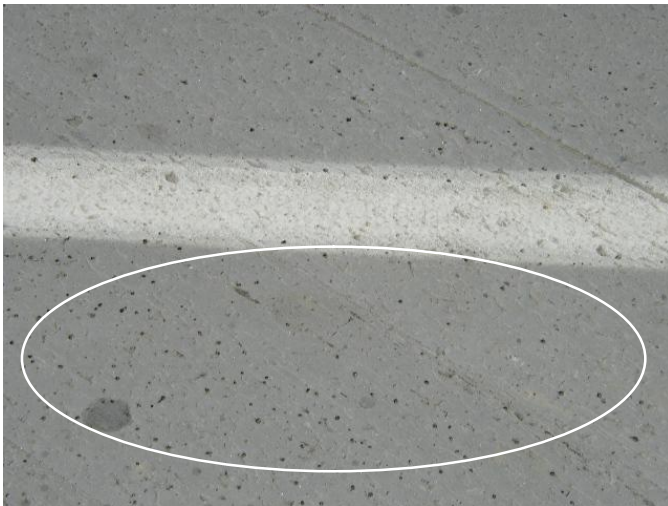


Photo 17 Bridgewater Crossing Spike Holes

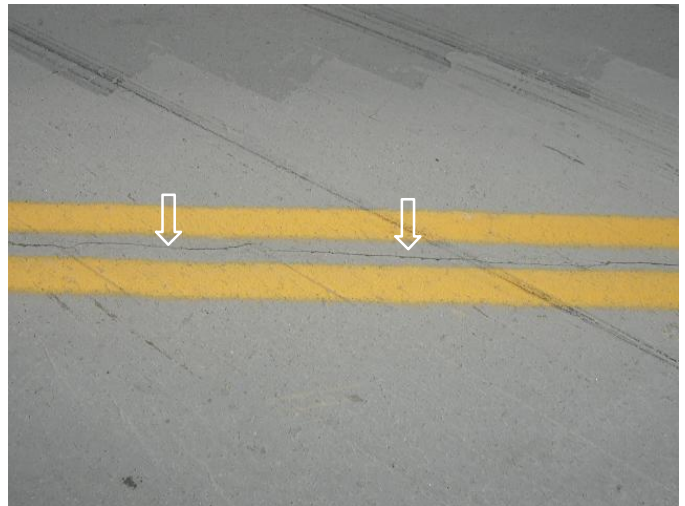


Photo 18 Bridgewater Crossing Centerline Crack



Photo 19 Bridgewater Crossing Track Marks

Summary

The experimental crossing mats are performing very well. Other than winter plow wear on the leading edge of the mats at high points of the roadway the mats are showing little signs of wear.

Snowmobile tracks have carbide spikes and cleats that leave marks in the mat when they cross. The marks are more abundant on each end of the mat than in the middle. This could be attributed to the snowmobiles waiting for traffic to clear before crossing and while waiting the spikes sink into the mat. When snowmobiles cross the mat the spikes don't have enough time or pressure to indent the mat or do not penetrate as deep. It appears that warm weather combined with traffic has sealed the marks in each wheel path.

A number of snowmobilers that use the crossings were interviewed. All comments were favorable. The users said there is less drag when crossing making it less stressful crossing busy routes.

At over \$4000 per site the decision to install more should consider long term maintenance repairs of the untreated site as well as the improved safety of the snowmobilers and the traveling public.

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